Breakout Session 2A: Nearshore, shallow water dynamics and processes

An immediate issue that surfaced in this session was defining the area deemed “nearshore” or “shallow water.”* It became clear that the definition of nearshore depends on the body of water (e.g., in Superior this zone may be 80m depth, whereas in Erie it may be only 20m, and may be only 2m in channels). The depths and distances at which these scales operate differ among the Great Lakes, and we must acknowledge that these scales play important role to address research questions in the nearshore zone.

The group identified several key outstanding questions in the nearshore environment that should be a priority if we are to understand the contributions of the nearshore environment to whole lake processes in the Great Lakes. It became clear that although we have a coarse understanding of bathymetry, substrate, community structure, and hydrology, the nearshore zone in and of itself is a research gap. As a relatively heterogeneous environment, the nearshore immediately presents itself as an environment where physical processes are dynamic. Data are very limited for many physical factors due to this heterogeneity. Consequently, estimates of bathymetry, resuspension events, current modeling (including offshore vs. longshore transport), and riverine nutrient loading (flow and concentration) all lack resolution.

One aspect of focus for this session was nutrient cycling, especially phosphorus. Key issues to address in this area include:

- Analyzing the nearshore shunt and its role over long timescales, in nutrient spiraling, and fate of phosphorus
- Quantifying recycling, hysteresis, and external loading contributions (i.e., tributaries, sewage outflows) to nutrient budgets

Dreissenid mussels emerged as a key area of research in the nearshore environment of the Great Lakes. Although general knowledge of mussel densities are known, a better understanding of the nearshore environment would better characterize the following aspects of Dreissenid dynamics:

- Detailed stocks (presence, cover) in the heterogeneous nearshore environment and how they are changing in time
- Ultimate fate of shells and soft tissue
- Turnover time of shells and soft tissue, and how this influences other cycles within the lake
- Influence of shell formation on the ecosystem service of carbon sequestration
- Restraint of resuspension and sedimentation by mussel beds

Other issues addressed in this session as key science needs for the nearshore Great Lakes environment included:

- Nutrient cycling, hydrology, and redox interactions at coastal wetland interfaces
- Nearshore-offshore coupling
- Influence of tributaries (i.e. number, magnitude of inputs, extent of nearshore zone housed by bays and/or river mouths)
- Winter dynamics
- Contrasting benthic-pelagic coupling in nearshore environment with the offshore environment (i.e., what makes the nearshore environment unique in these aspects?)
These gaps in understanding were identified as key research thrusts that can be captured with sampling at more detailed resolution, perhaps through increased use of observational technologies.

*I refer to nearshore and shallow water collectively as nearshore for the sake of simplicity, although research questions may address these two terms differently.*